

V. SUMMARY OF THE PROPOSED REGULATION

In this chapter, we provide a plain English discussion of the key requirements of the proposed regulation for auxiliary diesel engines operated on ocean-going vessels (or "vessels"). This chapter begins with a general overview of the regulation and the approach taken in developing the requirements in the proposal. The remainder of the chapter follows the structure of the proposed regulation and provides an explanation of each major requirement of the proposal. This chapter is intended to satisfy the requirements of Government Code section 11346.2, which requires that a non-controlling "plain English" summary of the regulation be made available to the public.

A. Overview of the Proposed Regulation

The proposed regulation requires that auxiliary engines operating within 24 nautical miles (nm) of the California coastline significantly reduce their diesel particulate matter (PM), nitrogen oxide (NOx), and sulfur oxide (SOx) emissions. Emission reductions can be achieved by using cleaner burning distillate marine fuels, or implementing alternative emission control strategies under an "Alternative Compliance Plan (ACP)." For vessels electing to comply with the fuel requirement, vessel operators will need to switch from the use of heavy fuel oil to marine distillate fuel within 24 nm of the California coastline, unless they already use complying distillate fuels or choose to use distillate fuels on a permanent basis. If operators choose to comply with the proposed regulation under an ACP, they must demonstrate that the alternative emission control strategies will achieve equivalent or greater emission reductions compared to the fuel requirements.

Our approach in developing the fuel and ACP requirements in the proposal was to apply the best available emission control strategy that could be applied to the variety of vessels visiting California ports. Factors considered when establishing these requirements included the potential for near-source risk reduction in port communities, the cost and technical feasibility of using the fuels specified in the proposal, and sufficient availability of the specified fuels at ports worldwide.

B. Purpose

The purpose of this proposed regulation is to reduce emissions of diesel PM, NOx, SOx, and "secondarily" formed PM (PM formed in the atmosphere from NOx and SOx). If adopted, the proposed regulation will achieve immediate, significant emission reductions upon implementation in 2007. Specifically, the proposed regulation will have the following benefits:

- diesel PM emission reductions will reduce the potential cancer risk, premature mortality and other adverse health impacts from PM exposure to people who live in the vicinity of California's major ports and shipping lanes;

- diesel PM emission reductions will reduce regional exposure to PM, and help continue progress toward State and federal ambient air quality standards for PM₁₀ and PM_{2.5};
- NOx emission reductions will reduce the formation of regional ozone and secondary nitrate PM; and
- reductions in SOx emissions will reduce the formation of secondary sulfate PM.

C. Applicability

This subsection explains who must comply with the proposed regulation. Except for the exemptions described below, the proposal applies to any person who owns or operates an ocean-going vessel within 24 nm of the California coastline. The definition of ocean-going vessel is key to this section. In general, ocean-going vessels include large cargo vessels and passenger cruise vessels (see section on "Definitions" below). The regulation applies to both U.S.-flagged vessels and foreign-flagged vessels. Foreign-flagged vessels are vessels registered under the flag of a country other than the United States.

The proposed regulation includes language clarifying that the proposal does not change any applicable U.S. Coast Guard regulations and that vessel owners and operators are responsible for ensuring that they meet all applicable U.S. Coast Guard regulations.

D. Exemptions

The proposed regulation includes three exemptions. First, the proposal does not apply to vessels while in "innocent passage." As defined in subsection (d) of the proposal, "innocent passage" generally means travel within the 24 nm boundary off California's coastline without stopping or anchoring, except in limited situations such as when the vessel is in distress or must stop to comply with U.S. Coast Guard regulations.

An exemption is included for two-stroke slow-speed diesel engines as defined in subsection (d) of the proposal. The design of these engines differs significantly from the four-stroke, medium speed engines used in virtually all auxiliary engine applications. While distillate fuels can be used in two-stroke slow-speed engines in some situations, the additional technical challenges associated with using distillate fuels in these engines make it impractical to subject these engines to the same performance standards as four-stroke medium speed engines.

An exemption is also included for military vessels. Military vessels primarily use military specification distillate fuels that must be used on a consistent basis for military equipment globally.

E. Definitions

The proposed regulation provides definitions for a number of terms that are not self-explanatory, or have specific meaning within the context of the proposed regulation. In this subchapter, we discuss some of the key definitions.

Auxiliary Engine

Auxiliary engines are defined as engines designed primarily to provide power for uses other than for direct, mechanical propulsion. Auxiliary engines include diesel generator set engines on diesel-electric vessels, which are used as a source of electricity for any use. Generally, auxiliary diesel engines on cargo vessels are connected to generators and are used to produce electrical power primarily for ship-board uses such as lighting and navigation equipment. These engines are generally four-stroke, medium speed engines. In contrast, the main propulsion engines on cargo vessels are generally very large two-stroke slow-speed engines of a significantly different design than auxiliary engines. Passenger cruise vessels are generally diesel-electric vessels, where several large diesel generator sets provide power for both propulsion and on-board electrical needs. These large generator sets are included in the proposed regulation as “auxiliary engines” because they are similar in design to the smaller auxiliary engines on cargo vessels. Specifically, they are four-stroke, medium-speed generator set engines.

Baseline

The California “baseline” is the boundary line that divides the land and internal waters from the ocean. This boundary line is determined by the United States Baseline Committee and shown on the official United States nautical charts published by the National Oceanic and Atmospheric Administration (NOAA). Because the waterline rises and falls with the tide, the baseline is defined with respect to the tides. For this regulation, we have defined the baseline as the mean lower low water line along the California coast, as shown on the applicable NOAA Nautical Charts authored by the NOAA Office of Coast Survey. The NOAA routinely updates its nautical charts to update hazards to navigation and other information considered essential for safe navigation and any changes made to the baseline by the U.S. Baseline Committee. It is our understanding that NOAA will be updating the charts for the California coast in the near future. The California baseline is used in the definitions of “Territorial Sea” (which extends to 12 nautical miles from the California Baseline) and “Contiguous Zone” (which extends to 24 miles from the California baseline).

Marine Gas Oil

Marine Gas Oil (MGO) is a marine grade distillate fuel very similar to on-road diesel fuel except that it has a higher flash point requirement and often a much higher sulfur content. The International Organization for Standardization (ISO) sets standards for marine fuels under International Standard ISO 8217, including fuels designated DMX

and DMA, which correspond to marine gas oil. For example, the maximum sulfur content for grade DMA fuel is 1.5 percent by weight, and the minimum flash point is 60 degrees Celsius. If a fuel meets all of the standards for DMA or DMX fuels in the applicable ISO standard, then it qualifies in the proposed regulation as "marine gas oil." In practice, on-road diesel fuel in California often meets the specifications for DMA fuel and is sold for marine use. In most cases, DMX grade fuel is primarily used only for emergency generators, so marine gas oil is generally DMA grade fuel.

Marine Diesel Oil

Marine Diesel Oil (MDO) is a marine grade distillate fuel very similar to marine gas oil except that it generally contains a small amount of marine residual fuel (heavy fuel oil) due to storage or transportation in tanks or piping that previously held marine residual fuels. The International Organization for Standardization (ISO) sets somewhat less stringent standards for MDO fuel, which corresponds to DMB grade fuel in ISO terminology. The sulfur content limit for DMB grade fuel is 2 percent, compared to 1.5 percent for DMA grade fuel (marine gas oil).

Ocean-going Vessel

An ocean-going vessel is defined as a vessel meeting any of the following criteria:

- a vessel with a "registry" (foreign trade) endorsement on its U.S. Coast Guard certificate of documentation, or a vessel that is registered under the flag of a country other than the United States;
- a vessel greater than or equal to 400 feet in length overall (LOA) as defined in the Code of Federal Regulations (50 CFR § 679.2, as adopted June 19, 1996);
- a vessel greater than or equal to 10,000 gross tons (GT ITC) per the convention measurement (international system) as defined in 46 CFR 69.51-.61, as adopted September 12, 1989; or
- a vessel propelled by a marine compression ignition engine with a per-cylinder displacement of greater than or equal to 30 liters.

The criteria in the definition of ocean-going vessel are designed to include vessels that travel internationally, such as container vessels, auto carriers, tankers, and passenger cruise vessels. The definition is also designed to exclude harbor craft such as tug boats, fishing boats and ferries, which will be subject to more stringent fuel requirements in 2007. Specifically, diesel fuel sold to harbor craft in California will be required to meet California on-road "vehicular" standards.

Territorial Sea and Contiguous Zone

Both the Territorial Sea and the Contiguous Zone represent internationally recognized over-water boundaries. The Territorial Sea extends 12 nm offshore of the California coastline (or "baseline"), while the Contiguous Zone extends from the Territorial Sea to 24 nm offshore of the California coastline. Together, these zones represent the region

subject to the proposed regulation approximately north of Point Concepción. South of this point, a boundary approximately 24 nm off the shoreline is defined by straight line segments. We selected this linear boundary south of Point Concepción because the Territorial Sea and Contiguous zone around the Channel Islands would bring the effective zone of the proposed regulation beyond the intended boundary of approximately 24 nm offshore of the California mainland coastline.

F. Cleaner Fuel Option

This section explains the types of fuels that may be used by operators of ocean-going vessels to comply with the requirements of the proposed regulation. Under the proposed regulation, starting on January 1, 2007, vessel operators can comply with the proposal by using one of the following fuels when operating their auxiliary engines within 24 nm of the California coastline: (1) marine gas oil; or (2) marine diesel oil with less than or equal to 0.5 percent by weight sulfur. A 0.5 percent sulfur limit is specified for marine diesel oil because it tends to have a higher sulfur level than marine gas oil. Marine gas oil used by vessels that visit California ports is expected to average at or below 0.5 percent sulfur based on the results of a survey sent to vessel operators in 2005. Specifically, the average sulfur content of distillate marine fuels used by vessel auxiliary engines was reported to be 0.5 percent, and we do not anticipate that this will increase in the future.

Starting on January 1, 2010, marine gas oil meeting a 0.1 percent sulfur limit is specified under the proposed regulation. This lower sulfur fuel will result in additional emission reductions of PM and SO_x, compared to the January 1, 2010 requirement. This standard is also consistent with a recently adopted European Union regulation. However, a feasibility analysis is required under the proposed regulation prior to implementation of this fuel requirement to investigate the supply, cost, and technical feasibility of using this fuel. Based on the results of this evaluation, modifications to this requirement may be proposed to the Board.

Under the proposed regulation, vessel emissions would be regulated up to 24 nm off the California coastline. The ARB has the authority to require emission reductions out to the California Coastal Water (CCW) boundary. This is the region within which emissions are likely to be transported onshore, and it extends beyond the 24 nm boundary. However, the 24 nm boundary was proposed because it significantly lowers the cost of the regulation while still providing the vast majority of the potential on-shore benefits in terms of reduced exposure to diesel PM. Specifically, about 75 percent of the auxiliary engine diesel PM emissions within 100 nm of the California coastline is emitted within the 24 nm boundary. The 24 nm boundary is also easily defined for vessel operators. The boundary is aligned in Central and Northern California with the outer boundary of the Contiguous Zone, an internationally recognized boundary which extends 24 nm offshore and is noted on most nautical charts. In Southern California, the boundary consists of straight line segments approximately 24 nm offshore of the coastline. This approximation is used because the Contiguous zone extends around

the Channel Islands, bringing the boundary well beyond 24 nm, and in some cases beyond the California Coastal Waters boundary

G. Recordkeeping and Reporting Requirements

Recordkeeping

Recordkeeping, in addition to ship-board inspections and fuel testing, is necessary for ARB enforcement staff to verify that a vessel operator is complying with the requirements of the proposed regulation. This section explains the recordkeeping requirements.

Beginning with the implementation of the fuel requirement on January 1, 2007, any person who owns or operates an ocean-going vessel within 24 nm of the California coastline will be required to maintain certain records (in English) for a minimum of three years. These requirements do not apply to vessels that travel along California's coastline in "innocent passage," meaning traveling without stopping or anchoring, except in limited situations. The records that must be maintained are as follows:

- the date, time, and position (longitude and latitude) of the vessel for each entry into and departure from the region covered by the proposed regulation;
- the date, time, and position (longitude and latitude) of the vessel at the initiation and completion of any fuel switching procedures used to comply with the fuel requirements in the proposed regulation. Completion of fuel switching procedures means the moment at which auxiliary engines have completely switched from one fuel to another fuel;
- the date, time, and position (longitude and latitude) of the vessel at the initiation and completion of any fuel switching procedures within the region covered by the proposed regulation;
- the type of each fuel used (e.g. marine gas oil) in each auxiliary engine operated within the region covered by the proposed regulation; and
- the types and amounts of fuels purchased for use on the vessel, and the actual percent by weight sulfur content of such fuels as reported by the fuel supplier or a fuel testing firm.

Reporting and Monitoring Provisions

These provisions explain when the records described above will be provided (reported) to ARB. The provisions also explain that access to vessels shall be provided to allow enforcement staff to verify compliance with the proposed regulation. For example, enforcement staff may need to access the vessel to inspect records instead of requesting that they be mailed, or they may need to obtain a sample of fuel used by the vessels auxiliary engines.

Under these provisions, the recordkeeping information specified in the proposed regulation must be supplied in writing to the Executive Officer upon request. Some of

the recordkeeping required by the proposed regulation may already be recorded to comply with other regulations or standardized practices. In these cases, the information may be provided to ARB in a format consistent with these regulations or practices, as long as the required information is provided.

Vessel owners or operations may be requested to provide additional information needed to determine compliance with the proposed regulation. For example, information about the auxiliary engines, fuel tanks, and fuel delivery system may be needed on a case-by-case basis.

To monitor compliance with the requirements of the proposed regulation, these provisions require that vessel owners or operators provide access to the vessel to employees or officers of the Air Resources Board. This is to include access to records necessary to establish compliance with the requirements of the proposal and access to fuel tanks or pipes for the purpose of collecting fuel samples for testing and analysis.

H. Noncompliance Fee Option

The proposal contains this provision to address the limited situations where a vessel operator may not be able to comply with the proposed regulation for reasons beyond their reasonable control, or it may be impractical to comply. Instead of providing exemptions for these situations, staff is proposing a provision that would allow a vessel owner or operator, under special circumstances, to pay a fee in lieu of complying with the proposed regulation. The funds collected under this provision would be used for marine or port emission reduction projects, with the goal of achieving equivalent or greater emission reductions near affected communities. Under this program, the vessel owners or operators would need to notify the Executive Officer that they will not meet the requirements of the regulation prior to entering the 24 nautical mile boundary (California Regulatory Waters). The fees under this program are designed to ensure that participants will not receive an economic advantage over vessel operators that directly comply with the proposed regulation. The fee schedule is graduated such that subsequent visits would result in increasing fee amounts.

This option could only be used in the following circumstances:

- the vessel owner is unexpectedly redirected to a California port and the vessel does not have a sufficient quantity of fuel complying with the requirements of the proposed regulation;
- due to reasons beyond the vessel operator's control, the vessel was not able to acquire a sufficient quantity of fuel complying with the requirements of the proposed regulation;
- due to reasons beyond the vessel operator's control, fuel necessary to comply with the requirements of the proposed regulation was found to be contaminated or otherwise out of compliance after the vessel left the last bunkering port prior to a California port call;

- modifications to a vessel are required to comply with the proposed regulation and the vessel operator is not able to complete the modifications in time to meet the January 1, 2007 requirements in the proposal. The vessel operator must submit a Compliance Retrofit Report that identifies the modifications necessary and the date by which modifications will be completed; and
- modifications to a vessel are required to comply with the proposed regulation and the vessel will visit a California port a maximum of two times per calendar year, and four times over the life of the vessel after January 1, 2007 (the effective date of the requirements in the proposal).

The non-compliance fees funds would be deposited into the port's Noncompliance Fee Settlement and Air Quality Mitigation Fund prior to leaving the port. The fee increases with each port visited while complying with this provision. The port visits are cumulative over the life of the vessel. For example, if a diesel-electric vessel visits a California port and uses the noncompliance fee option for the first time, the vessels owner would pay a fee of \$32,500. If that same vessel visits another California port sometime later and again uses the noncompliance fee option, the vessel owner would pay a fee of \$65,000; since this was the second port visited under this provision. The basis of the fees is discussed in Appendix H, Basis for the Noncompliance Fees. The fee schedule is shown in Table V-1, Noncompliance Fee Schedule, Per Vessel.

Table V-1: Noncompliance Fee Schedule, Per Vessel

Noncompliance Fee Schedule		
Visit	Fee (per vessel)	
	Diesel-Electric Vessels	Other Vessels
1 st Port Visited	\$32,500	\$13,000
2 nd Port Visited	\$65,000	\$26,000
3 rd Port Visited	\$97,500	\$39,000
4 th Port Visited	\$130,000	\$52,000
5 th or more Port Visited	\$162,500	\$65,000

I. Alternative Compliance Plan

The alternative compliance plan (ACP) is included in the proposed regulation to provide vessel owner/operators with the flexibility to implement alternative emission control strategies that achieve equivalent or greater emission reductions than the distillate fuel compliance option. Alternative emission control strategies may include the use of shore-side electrical power, engine modifications, exhaust treatment devices such as diesel oxidation catalysts, the use of alternative fuels or fuel additives, and operational controls such as limits on idling time.

Application Process

To comply with the proposed regulation under the ACP, a vessel owner or operator must submit an application to ARB. The application must demonstrate that the alternative emission control strategy employed will achieve equivalent or greater emission reductions in PM, NO_x, and SO_x from auxiliary engines, relative to the emission reductions that would have occurred by using the distillate fuel compliance option. The proposed regulation specifies basic information that must be included in the application, such as emissions test data, and other information that demonstrates the emissions level to be achieved with the proposed alternative emission control strategy. ARB staff will develop a guidance document to assist applicants in making a demonstration of equivalent emission reductions.

The scope of the ACP is limited to auxiliary engines. In other words, emission reductions from main engines or other sources may not be included in the ACP. In addition, compliance with the ACP can be demonstrated on an individual vessel basis, or across a fleet of vessels with the same owner or lessor.

After an application for an ACP is submitted, ARB has 90 days to accept or deny the application. If ARB staff finds that additional information is necessary, the applicant will be provided an opportunity to submit the necessary information. It should be noted that submittal of an ACP application does not mean that the applicant is complying with the regulation. The applicant must comply with the fuel requirements and other provisions of the regulation until an ACP application is granted. For this reason, applicants may want to submit applications at least 90 days prior to the implementation date of the fuel requirement on January 1, 2007.

ARB may revoke or modify an ACP if it believes that an ACP has been granted to an owner or operator that is not complying with the provision or no longer meets the criteria of an ACP. In addition, ACP applications may be inadequate if the 0.1 percent sulfur MGO requirement effective on January 1, 2010, is implemented. As such, applicants may want to consider pursuing alternative emission control strategies that will also comply with this more stringent emission level.

Additional provision for applicants using shore-side power

There is an additional provision in the ACP that applies to vessels that connect to shore-side power, subject to certain conditions. Specifically, the vessel must connect to power supplied by a utility company (or another source with equivalent or lower emissions per unit of delivered energy) and shut down all auxiliary engines subject to the proposed regulation. The vessel must also connect to shore power within one hour after the vessel is secured at the port terminal, and continuously use this power until no more than one hour prior to when the vessel leaves the terminal.

If these conditions are met, the vessel would not be subject to the fuel-based emission limitation during travel from a previous port to a California port where shore-side power is to be used, while docked prior to utilizing shore-side power, and during travel to a subsequent port. For example, a vessel operator could run their auxiliary engines on heavy fuel oil while traveling to a California port where shore-side power is to be used. After docking at this port, the vessel would have one hour to shut off all its auxiliary engines and begin using shore-side electrical power. When preparing to depart, the vessel could disconnect from shore-side power and run their auxiliary engines on heavy fuel oil for up to one hour prior to departing. While departing port, the vessel operator could continue to run the auxiliary engines on heavy fuel oil.

If two California ports are visited in succession, and a vessel utilizes shore-side power only at the second port, the vessel would be considered to meet the emission reduction requirements of the ACP: (1) while traveling from the first port to the second port; (2) while dockside at the second port; and (3) while departing the second port. While traveling to the first port, and during mooring at the first port, the vessel must comply with the requirements of the regulation through the use of distillate fuels or other emission control strategies (See Figure V-1). For example, while traveling to the first port, a vessel operator may switch from heavy fuel oil to distillate fuels in the auxiliary engines prior to entering the 24 nautical mile boundary off California's coastline. The distillate fuel would continue to be used while at dockside. However, as soon as the vessel operator left the first port, the operator could switch to heavy fuel oil, which could be used thereafter except when the auxiliary engines are shut down while the vessel is connected to shore-side power at the second port.

If two California ports are visited in succession and a vessel utilizes shore-side power at the first port visited, the vessel would meet the requirements of the ACP during travel to this first port, during the time the vessel is dockside at the first port, and while traveling from the first to second port. While dockside at the second port, and during the departure from the second port, the vessel must comply with the requirements of the regulation through the use of distillate fuels or other emission control strategies (See Figure V-2 below). For example, while traveling to the first port, a vessel operator may use heavy fuel oil. The heavy fuel oil could continue to be used while at dockside for up to one hour, after which the auxiliary engines must be shut off while shore-side power is connected. While preparing to depart, the vessel could disconnect from shore-side power and begin operating the auxiliary engines on heavy fuel oil. Heavy fuel could also be used in transit to the second port. However, at some point prior to docking at the second port, the vessel operator would need to switch to distillate fuel or implement an alternative emission control strategy, which would be used at dockside and while the vessel departs the second port.

The additional provisions for applicants using shore-side power are included in the proposed regulation to encourage the use of shore-side power in recognition of its ability to greatly reduce diesel PM emissions released close to portside communities. In addition, the use of shore-side power results in significant reductions in carbon dioxide (a global warming gas).

Applicants do not have to utilize this provision of the ACP in all cases when their emission control strategies utilize shore-side power. They may choose to comply with the proposal using shore-side power under the general ACP provisions. For example, if they cannot connect within one hour of mooring at the terminal, they can utilize the general provisions of the ACP. However, the special provisions for shore-side power provide some advantages. First, the application process would be simplified because less information would be needed to demonstrate compliance. In addition, there may be instances where the emissions from a vessel would be greater overall while utilizing this provision compared to compliance with the fuel requirements in the proposed regulation. However, we believe the benefits of reducing the risk resulting from near-shore PM emission reductions will generally offset any potential increases in overall emissions.

Figure V-1

**Vessel Uses Auxiliary Engine Power at First Port Call
and Shore-side Power at Second Port Call**

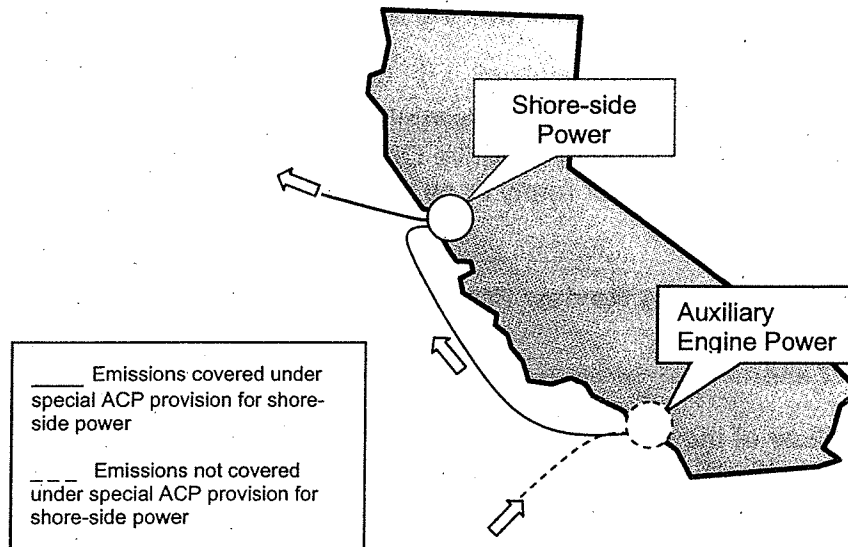
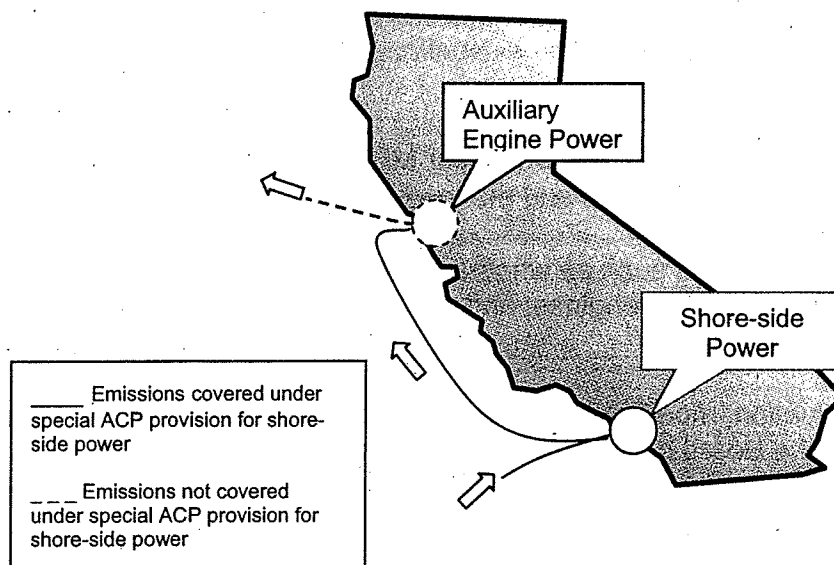


Figure V-2

**Vessel Uses Shore-side Power at First Port Call
and Auxiliary Engine Power at Second Port Call**



J. Test Methods

The proposed regulation includes test methods to determine whether fuels meet the requirements of the proposed regulation. Specifically, the proposed regulation references International Standard 8217 as adopted by the International Organization for Standardization in 1996. ISO 8217 includes the properties necessary for a fuel to qualify as DMX or DMA grade fuel (marine gas oil), or DMB grade fuel (marine diesel oil), and specifies the test methods to be used to determine compliance with each of these properties. The proposal also includes the test method to be used to determine the sulfur level of these fuels.

The proposed regulation allows the use of alternative test methods demonstrated to be equally accurate, as approved by the Executive Officer of ARB. For example, ASTM equivalent methods are available for many or all of the ISO test methods specified in ISO 8217.

K. Sunset and Technology Review Provisions

Sunset Provision

If the Executive Officer of the ARB determines that the IMO or the U.S. EPA adopts regulations that will achieve equivalent or greater emission reductions from ocean-going vessels in California, compared to the emission reductions achieved by the proposed regulation, then the Executive officer will propose to the Board for its consideration terminating or modifying the requirements of the proposed regulation. This provision recognizes that it would be preferable to adopt regulations for ocean-going vessels on a national or international basis.

Feasibility Review

This section describes the feasibility evaluation that will be conducted relative to the January 1, 2010, fuel requirement to use 0.1 percent sulfur marine gas oil. Under these provisions, an evaluation of the feasibility of this fuel requirement will be conducted by ARB staff no later than July 1, 2008. The evaluation will consider, at a minimum, the following:

- the current availability of 0.1 percent sulfur MGO at bunkering ports worldwide;
- the ability of petroleum refiners and marine fuel marketers to supply this fuel by 2010;
- technical considerations such as whether fuel at this lower sulfur level will be compatible with all marine engines; and
- the cost of this fuel.

If, based on the evaluation, modifications to the regulation are necessary, staff will propose changes to the Board prior to January 1, 2009, (a year prior to the implementation date of the 0.1 percent sulfur fuel standard).

L. Severability

This provision states that if a particular section of the proposed regulation is held to be invalid, the remainder of the proposal shall continue to be effective.

M. Regulatory Alternatives

The Government Code section 11346.2 requires ARB to consider and evaluate reasonable alternatives to the proposed regulation and provide the reasons for rejecting those alternatives. ARB staff evaluated five alternative strategies to the current proposal. Based on the analysis, none of the alternative control strategies were considered more effective than the proposed regulation. Full implementation of the proposed regulation is necessary to make progress toward ARB's goals of: (1) reducing diesel PM by 85 percent in 2020, as described in the Diesel Risk Reduction Plan; and (2) achieving State and federal air quality standards for PM and ozone. The proposed regulation provides vessel operators with the flexibility to pursue alternative emission control strategies if they choose not comply with the fuel requirements in the proposal.

This section discusses each of the five alternatives and provides reasons for rejecting those alternatives.

Alternative 1: Do Nothing

As discussed in Chapter VII, the proposed regulation will result in significant reductions in diesel PM, NO_x, and SO_x emissions. The diesel PM reductions are an important element of the Diesel Risk Reduction Plan, and along with other regulations to be adopted by ARB, will contribute to reducing cancer and noncancer health risks to the public associated with inhalation exposure to emissions of diesel PM.

The emission reductions from the proposal are also necessary to make progress toward compliance with State and federal air quality standards for ozone and PM in nonattainment areas throughout the State. As discussed in Chapter IV, NO_x and SO_x emissions form "secondary" nitrate and sulfate PM, respectively, in the atmosphere, while NO_x emissions contribute to the formation of ozone.

In addition, ARB is required by H&SC Section 39658 to establish regulations for toxic air contaminants (TACs) such as diesel PM. Further, H&SC Sections 39666 and 39667 require the ARB to adopt measures to reduce emissions of TACs from nonvehicular and vehicular sources. In consideration of ARB's statutory requirements and the recognized potential for adverse health impacts to the public resulting from exposure to diesel PM and ozone, this alternative is not a reasonable option.

Alternative 2: Rely on U.S. Environmental Protection Agency (EPA) and International Maritime Organization (IMO) Regulations

As discussed in subsection K above, the proposed regulation includes a “sunset” provision which requires the Executive Officer of ARB to consider terminating the requirements of the proposed regulation if it is determined that the U.S. EPA or IMO adopts regulations that will achieve equivalent or greater emission reductions from vessel auxiliary engines compared to the emission reductions achieved by the proposed regulation. This provision recognizes that it would be preferable to adopt regulations for ocean-going vessels on a national or international basis. However, existing IMO and U.S. EPA regulations will not achieve the needed emission reductions from the proposal in the near term (prior to 2010), and it appears unlikely that the U.S. EPA or IMO will adopt equally effective regulations in the next foreseeable future. The following is a brief summary of the status of IMO and U.S. EPA activities supporting our position that we cannot wait for IMO or U.S. EPA to act.

IMO Annex VI NOx Standards

These standards apply to marine diesel engines greater than 130 kilowatts, which would include the auxiliary engines covered by the ARB staff proposal. However, these standards only apply to NOx emissions, and therefore would not achieve the significant PM benefits of the proposed regulation:

U.S. EPA 1999 Category 1&2 Engine Rule

The standards in this rule apply to new “category 1 & 2” engines (engines with a displacement less than 30 liters per cylinder), which would apply to most auxiliary engines covered by the ARB staff proposal (except the engines on diesel-electric vessels such as cruise vessels). This rule specifies standards for NOx plus hydrocarbons, PM, and carbon monoxide. However, this rule only applies to new engines in U.S.-flagged vessels, which make up a very small proportion (less than 10 percent) of the vessels that visit California ports. In addition, there is a foreign-trade exemption for U.S.-flagged vessels.

U.S. EPA 2003 Category 3 Engine Rule

The U.S. EPA recently adopted standards for new “category 3” engines (the large engines used for propulsion of ocean-going vessels). These NOx standards would apply to the large generator set engines used on diesel-electric vessels such as cruise vessels. However, the standards are identical to the IMO NOx standards and would only achieve modest NOx emission reductions and no diesel PM reductions. In addition, they only apply to new engines on U.S.-flagged vessels, which represent a very small proportion of the vessels visiting California ports. In this rulemaking, U.S. EPA also addresses “category 1” and “category 2” engines, with a displacement at or above 2.5 liters per cylinders but less than 30 liters per cylinder (typical of auxiliary engines used on ocean-going vessels). On U.S.-flagged vessels, these engines would

be required to meet NOx standards equivalent to the IMO standards. In addition, beginning in 2007, these engines would be subject to the U.S. EPA's standards for category 1 and 2 engines adopted in 1999. In this rulemaking, U.S. EPA also eliminated the foreign trade exemption included in U.S. EPA's 1999 rule. However, all these requirements would only apply to U.S. flagged vessels, which represent a small proportion of the vessels that visit California ports.

EPA Nonroad Diesel Rule

Among other requirements, this rule would limit the sulfur content of diesel fuels for non-road applications. For marine use, the rule would limit the sulfur content in diesel fuel to 0.05 percent (500 ppm) in 2007, and 0.0015 percent (15 ppm) in 2012 (EPA, 2004). However, this rule does not apply to marine diesel oil or heavy fuel oil. Since most ocean-going vessel auxiliary engines use heavy fuel oil, this would have little impact in reducing emissions from this source.

Potential Tier II EPA Category 3 New Engine Standards

The U.S. EPA reportedly intends to adopt more stringent technology-forcing Tier 2 standards for category 3 engines in April, 2007. (EPA, 2003). However, these standards may again only apply to U.S.-flagged vessels, and may not address PM emissions. In addition, we estimate that such standards would become effective for new engines in the 2010 timeframe and the emission reductions achieved by such a measure would phase in gradually as new vessels enter into service. As such, the measure would not be expected to achieve significant reductions until well after 2010.

Sulfur Emission Control Area (SECA)

The U.S. EPA, in association with ARB and other air quality agencies, is currently investigating the creation of SECA's under a process provided by the IMO. Specifically, the IMO's Annex VI ("Regulations for the Prevention of Air Pollution from Ships") of the MARPOL Convention provides a mechanism to require the use of marine fuel with a sulfur content limit of 1.5 percent in designated areas. The formation of a SECA may provide significant and necessary PM and SOx emission reductions to California if a West Coast SECA is established. However, the benefits of such a program would not be comparable to the ARB staff proposal. The percent PM and SOx emission reductions achieved from the use of 1.5 percent sulfur heavy fuel oil are far less than the reductions that would be achieved by the use of the distillate fuels specified in the proposed regulation. Specifically, the U.S. EPA estimates an 18 percent PM reduction and a 44 percent SOx reduction from the use of 1.5 percent heavy fuel oil (EPA, 2002). We estimate the use of the distillate fuel will result in a 75 percent PM reduction, an 80 percent SOx reduction, and a 6 percent NOx reduction. It should be noted that the use of 1.5 percent heavy fuel oil may result in larger emission reductions overall because it would apply to the main and auxiliary engines of vessels, whereas the ARB staff proposal would only apply to auxiliary engines. However, the ARB staff proposal would achieve far greater emission reductions at dockside where diesel PM reductions are

most critical. In addition, ARB staff plans to develop strategies to reduce the emissions from main engines on marine vessels in the next year or two.

A comparison between the ARB staff proposal and the potential regulations discussed in Alternative 2 are summarized in Table V-2. As shown, none of the potential regulations are expected to achieve the same benefits as the measure proposed by ARB staff.

Table V-2: Comparison between Potential IMO/U.S. EPA Proposals and the ARB Staff Proposal

Regulation	Comparison to the ARB Staff Proposal
IMO Annex VI NOx Standards	<ul style="list-style-type: none"> Standards do not reduce PM
U.S. EPA 1999 Category 1&2 Engine Rule	<ul style="list-style-type: none"> Standards only apply to U.S. flagged vessels Benefits phase in slowly starting in 2007 for most engines Foreign-trade exemption for U.S. flagged vessels
U.S. EPA 2003 Category 3 Engine Rule	<ul style="list-style-type: none"> Standards only apply to U.S. flagged vessels Standards same as IMO and do not reduce PM for category 3 engines Rulemaking eliminates foreign trade exemption for certain category 1 & 2 engines on U.S.-flagged vessels
U.S. EPA Nonroad Diesel Rule	<ul style="list-style-type: none"> Specifies sulfur limits for diesel fuel used in marine applications, but exempts marine diesel oil & heavy fuel oil
Potential Tier II EPA Category 3 New Engine Standards (2007 adoption expected)	<ul style="list-style-type: none"> Standards may only apply to U.S.-flagged vessels Standards may not reduce PM Standards not expected to be effective until circa 2010 Benefits phase in slowly beginning in 2010 with vessel turnover
Potential IMO SECA off California Coast	<ul style="list-style-type: none"> Significantly less reductions in diesel PM and SOx at dockside Standards expected to be effective later than the ARB staff proposal if implemented No NOx benefit

Alternative 3: Use Marine Distillate Fuels Only at Dockside

Under this alternative, ocean-going vessels visiting California ports would only be required to use marine distillate fuels at dockside. The emission reductions under this proposed alternative would be reduced by a minimum of 40 percent compared to the proposed regulation because the emissions from auxiliary engines on vessels at sea within the 24 nm boundary during transit would no longer be controlled. Fewer health benefits would result from this approach, and the loss in emission reductions would be greater if auxiliary engines are allowed to transition from one fuel to another at dockside, since such transitions can take an hour or more.

The recurring fuel costs associated with the proposed regulation would be lower under this alternative. There could also be a reduction in the cost impacts associated with modifying vessels to use distillate fuel, particularly with the diesel-electric vessels. For

example, we anticipate that some vessels may not need an additional tank for storing distillate fuel if the fuel will only be used at dockside. However, given the variability involved, we cannot quantify the reduction in retrofit costs under this alternative. Nevertheless, looking at the overall industry costs, the retrofit costs are relatively small compared to the recurring added fuel costs. Therefore, the overall cost-effectiveness, in terms of dollars per pound of emissions reduced, of the alternative is expected to be similar to the proposed regulation. In summary, this alternative has similar cost-effectiveness to the ARB staff proposal, due to both reduced cost and reduced emission reductions. However, given the feasibility, cost-effectiveness, and health benefits of requiring reductions both at dockside and within the specified 24 nautical mile zone, Alternative 3 was judged inferior to the proposed regulation.

Alternative 4: Special Provisions for Diesel-Electric Vessels

Under this alternative, diesel electric-vessels would have three compliance options: (1) use distillate fuels only at dockside as in Alternative 3 above; (2) use 1.5 percent sulfur heavy fuel oil within the 24 nm boundary and at dockside; or (3) retrofit vessels to use shoreside electrical power and connect at California terminals where the facilities are available.

Under the first option, the same situation applies as in Alternative 3, except that the option only applies to diesel electric-vessels (primarily cruise vessels). This option would achieve significantly less emission reductions and the cost would be reduced proportionately. The cost-effectiveness is expected to be similar to the staff's proposal.

For the option to use 1.5 percent sulfur heavy fuel oil, the estimated PM emission reductions are expected to be significantly less (about 18 percent versus 75 percent for staff's proposal relative to an engine burning standard high sulfur heavy fuel oil). SOx emissions would be reduced by about 44 percent versus 80 percent for staff's proposal, and there would be no NOx reductions. On the other hand, the cost of the 1.5 percent sulfur heavy fuel is currently much less than marine gas oil. As a result, the cost of this option would be considerably less than the cost associated with staff's proposal. Overall, we expect that the PM cost effectiveness of this option would be in the same range as the proposed regulation.

The third option, utilizing cold ironing where available is difficult to analyze because vessels retrofitted for cold ironing would only plug into shoreside power if it is available. To date, only a few California port terminals have shoreside power facilities installed. Additional facilities are anticipated at the Ports of Los Angeles, Long Beach and Oakland. However, it will be several years before new additional shoreside power facilities are operational. As a result, we cannot quantify the emissions reductions for this option at this time.

Overall, the emission reductions from any of these options under this alternative would be significantly less than the ARB staff proposal, although the cost-effectiveness would be similar. As with Alternative 3, we judged this option to inferior.

Alternative 5: Exemption of Power used for Propulsion in Diesel-Electric Vessels

Diesel-electric vessels have large diesel engines coupled to generators that supply electrical power for both propulsion and shipboard electrical uses. Under this alternative, only the power generated for shipboard electrical uses would be subject to the proposed regulation. The power generated for propulsion would not be subject to regulation.

Industry sources have suggested this alternative because the engines used for propulsion in other vessel types are not controlled under the staff proposal. Specifically, most other (non-diesel-electric) vessels have separate main engines mechanically connected to a propeller used for propulsion, and auxiliary engines used for shipboard power. The main engines would not be subject to control, while the auxiliary engines would be covered. For diesel-electric vessels, which have generator set engines that supply electrical power for both propulsion and shipboard electricity, all of the power and emissions generated by these engines would be subject to control. As such, the costs are higher for operators of these vessels.

However, we feel it is appropriate to control all of the emissions from the engines on diesel-electric vessels, whether generated for shipboard electrical power or propulsion, because it is technically feasible and cost-effective to do so. The engines used in diesel-electric vessels are very similar to the auxiliary engines used in other vessels, except that they are larger. Specifically, they are four-stroke, medium speed engines used in generator set applications. The main engines in other vessels are generally two-stroke slow-speed engines. These engines have a significantly different design that is less amenable to the use of distillate fuels.

Alternative 5 would achieve less emission reductions than the staff proposal because the amount of power (and thus emissions) generated by diesel-electric vessels for propulsion is significant, and would not be controlled under this alternative. The cost to ship operators would also be reduced proportionally because they would not need to use the more expensive distillate fuels (or other emission control strategies) for the power generated for propulsion. However, overall, the cost-effectiveness is expected to be similar to the staff's proposal.

Another consideration is the difficulty in separating out the power generated for propulsion and shipboard electricity. For example, a typical diesel-electric cruise ship will have varying shipboard electrical power needs based on factors such as the effect of temperature on space heating or cooling for passenger cabins. Propulsion power needs will also vary based on the speed of the vessel and ocean currents. Even if the power used only for shipboard electrical uses could be clearly distinguished, it may be difficult for ship operators to limit the emissions only from the amount of power for shipboard use separately from the power used for propulsion. Extensive recordkeeping would be necessary to ensure compliance under this alternative.

In summary, this alternative has similar cost-effectiveness to the ARB staff proposal, due to both reduced cost and reduced emission reductions. This alternative would also require burdensome recordkeeping. Given the cost-effectiveness, technical feasibility, and health benefits of controlling emissions from all power generated by these engines, Alternative 5 was judged inferior to the proposed regulation.

REFERENCES

(EPA, 2002) United States Environmental Protection Agency, *Control of Emissions of Air Pollution from New Marine Compression-Ignition Engines at or Above 30 Liters/Cylinder*, Notice of Proposed Rulemaking, April 30, 2002, Table VI.F-1.

(EPA, 2003) United States Environmental Protection Agency Regulatory Announcement, *Emission Standards Adopted for New Marine Diesel Engines*, EPA420-F-03-001, January 2003.

(EPA, 2004) United States Environmental Protection Agency Fact Sheet, *Clean Air Nonroad Diesel Rule*, EPA420-F-04-032, May 2004.